

EXHIBIT F



The clear solution for data center cooling

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Components

The CarnotJet™ includes three main components: Rack, Pump Module, and Control Module.

Rack:

The CarnotJet™ features a rack system that is similar to traditional air-cooled systems. The difference is that the CarnotJet™ accepts servers vertically rather than horizontally and then fully submerges them in GreenDEF™ non-conductive coolant. With 1,200x times more heat retention by volume than air, GreenDEF™ provides efficient, uniform, and powerful cooling for servers.

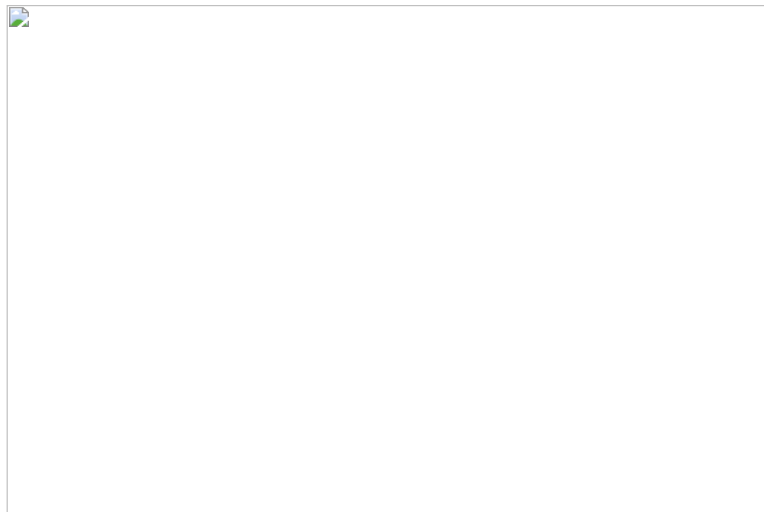


Figure 1. A CarnotJet™ Rack installed on modular secondary containment

We offer Racks in standard capacities of 10U, 42U, and 60U, with custom sizes available. Our 42U Rack (pictured above) is our most common build.

Our standard 42U Rack takes up 13 sq. ft. of floorspace and weighs roughly 3,300 lbs when fully loaded. The Rack takes up more floor space than a standard air-cooled cabinet — but unlike an air-cooled cabinet, there is no need for hot-aisle/cold-aisle floor space, chillers of any kind, air conditioners, or any other refrigerant-based equipment. The result is that square feet per rack is about the same as for an air-cooled cabinet.

The CarnotJet™ is designed to accept nearly all 19" rack-mounted servers, regardless of make, with three simple modifications performed by a GRC Service Engineer: removal of fans (fans are unnecessary for fluid submersion), encapsulation of hard drives, and replacement of thermal grease with an insoluble substitute.

Our Racks also feature integrated server rack rails to allow for easy installation and removal of servers. The Rack will handle up to 100kW of capacity depending on the size and power of the Pump Module. Upgrades to support higher densities are performed on the Pump Module rather than the Rack, enabling easy future upgrades in server density.

Pump Module:

One Pump Module is used for approximately 100kW of server power, typically 4-6 Racks. The Pump Module contains pumps, filters, and either coolant-to-water heat exchangers, or, in the case of our 10U Evaluation unit, a coolant-to-air radiator. Pump Modules can be located in the data center periphery or under an existing raised floor (if floor space is at a premium).

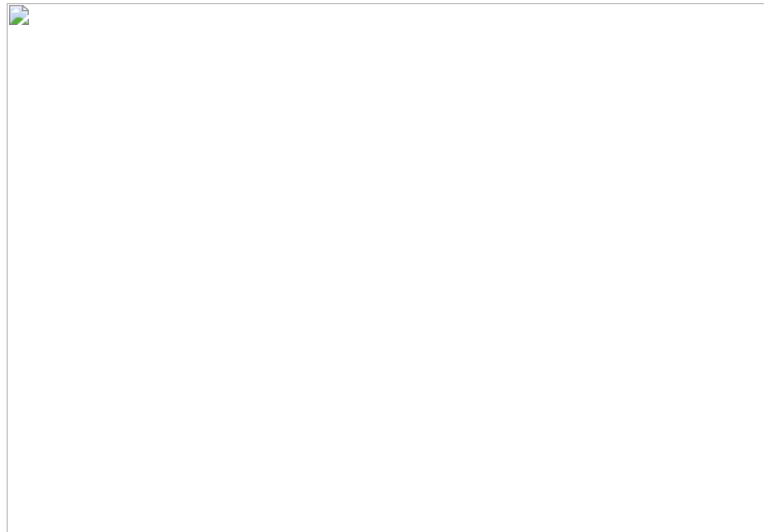


Figure 2. Pump module featuring 2N redundancy (side and top covers removed).

The Pump Module (shown above) is responsible for cooling and recirculating the GreenDEF™ coolant.

At its most basic level, the Pump Module draws heated coolant from the Rack, filters it, expels the excess heat through the specified heat-exchange method, and returns the coolant to the Rack. It also controls fluid mixing within the tank to promote a stable and uniform cooling environment for the servers ($\pm 1^\circ \text{C}$ throughout the Rack).

The pump module also features an independent secondary system for backup. If either system should fail, the other will not be affected; cooling will continue undisturbed.

Finally, the CarnotJet's™ Pump Module is very quiet compared to a Computer Room Air Conditioner (CRAC), and the servers are virtually silent without their fans. The lack of noise makes for a vastly different data center environment.

Control Module

The Control Module manages coolant flow and heat-exchanger fan speed (or pump speed) using a closed-loop temperature-control algorithm to ensure that the process is always operating as efficiently as possible for a given heat load.

Advanced features such as temperature analysis, pressure and coolant level verification, power consumption, smart monitoring and diagnostics, and intelligent optimization allow for *lights-out* management. Control Module outputs include log files of the above parameters, e-mail and SMNP

diagnostic alerts, and hourly status condition updates.

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Additional Features

Cable Management

Power and communication cables are connected and secured to the back plane of the server before the server is lowered into the Rack. Cable guides on the inside of the Rack ensure that cables do not become tangled. Cables can then be connected to PDUs or Switches mounted within the Rack or bolted to a supplied bracket on the side of Rack.

Spill Containment

Containment restricts incidental coolant drips or spills to the area immediately around the Racks/Pump Modules and provides for no-slip floors. For smaller installations, modular and portable containment platforms can be installed very easily and are simple to move or to uninstall. (See TACC photos in the [gallery](#).) For larger, more permanent installs, we typically install a perimeter berm around the racks with an expanded-metal catwalk laid in the service isles. (See Midas Networks photos in the [gallery](#).)

Final Heat Exchanger

Multiple options exist to reject heat to the outside air. We can use an evaporative cooling tower, the waste/return line of the chiller (reducing compressor lift and improving efficiency), or, depending on the climate and the size of the installation, we can use a coolant-to-air radiator.

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Installation Requirements

The CarnotJet™ has four basic installation site requirements: a roof, a level floor, electricity, and access to water or outside air (depending on the final heat-exchange method).

We have successfully installed our system on a loading dock, an unfinished data center floor, a concrete pad, and in a medium-sized trailer.

Because the CarnotJet™ uses a moving fluid with a high heat capacity, we have few concerns about ambient air temperature, humidity, or barometric pressure. The flow of heat (or cold) to and from the ambient air to the Rack is minimal.

We welcome both retrofit and new-build (Greenfield) installations.

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Technical Specifications

	Evaluation Unit	Standard Unit
Rack Capacity	10U	42U per rack (4 racks per pump module)
Rack Specifications	9 square feet 100 lbs	13 square feet 300 lbs
Pump Module Capacity	Supports 5kW (single rack)	Supports 100kW (up to 4 racks)
Pump Module Specifications	6 square feet 400 lbs	15 square feet 1,000 lbs
GreenDEF Coolant	75 gallons	250 gallons/rack
Secondary Containment	Modular platform (52-in. x 52-in.)	Modular or installed
Price	Nominal monthly fee (plus shipping + installation)	Per Watt + server modifications

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